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NEW RECORDS OF *HATCHERIA MACRAEI* (SILURIFORMES, TRICHOMYCTERIDAE) FROM CHILEAN PROVINCE

NUEVOS REGISTROS DE HATCHERIA MACRAEI *(SILURIFORMES, TRICHOMYCTERIDAE) EN LA PROVINCIA CHILENA*

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RESUMEN

Describimos nuevos registros de *Hatcheria macraei* (bagre Patagónico) en el área sur-central de Chile. Ello representa una ampliación significativa del rango de distribución de esta especie. Estos nuevos registros tienen importantes implicancias biogeográficas, dado que reportamos a *H. macraei* dentro de la Provincia Chilena, bastante más al norte de su límite distribucional previo en Chile, restringido a la Provincia Patagónica. Además, informamos en este trabajo de un nuevo carácter, correspondiente a la forma de la aleta dorsal, el cual permite una rápida y fácil discriminación entre *H. macraei* y *Trichomycterus areolatus*, tanto en terreno como en laboratorio. Este estudio alerta sobre la necesidad de identificar cuidadosamente los bagres de la familia Trichomycteridae del sur de Chile.

PALABRAS CLAVE: Trichomycteridae, *Hatcheria macraei*, *Trichomycterus areolatus*, morfología, merística.

ABSTRACT

We describe collections of *Hatcheria macraei* (Patagonian catfish) from south-central Chile. This represents a significant range extension for this species. These new records have important biogeographic implications as *H. macraei* is now recorded within Chilean Province, far north of its previous distributional limit in Patagonian Province. We document a new character, the shape of the dorsal fin, which allows quick and easy discrimination between *H. macraei* and *Trichomycterus areolatus* in the field or laboratory. This study highlights the need for careful identification for trichomycterid catfishes from southern Chile.

KEYWORDS: Trichomycteridae, *Hatcheria macraei*, *Trichomycterus areolatus*, morphology, meristics.

INTRODUCTION

Hatcheria is a monotypic genus of catfish in the family Trichomycteridae. Its recorded distribution is mostly within Argentina and to a lesser extent in Chile. Within Argentina *H. macraei* (Patagonian catfish) is widespread and typically common in Atlantic draining rivers from the Río Colorado south to the Río Chubut (Figure 1). It is also known in Argentina from the headwaters of most Pacific draining rivers from the Río Manso south to Río Blanco (Liotta 2006, Gomez 1990). In Chile the distribution is poorly documented. Several records exist for Río Aysén including Eigenmann (1909), Arratia *et al*. (1981, 1983), Zama & Cardenas (1984) and Campos *et al*. (1984). Campos *et al*. (1998)

listed them from General Carrera Lake (Río Baker) and the Aysén River. We could not find any other specific details of *H. macraei* records from Chile. Dyer (2000) listed them as being present in rivers of continental Chiloé and Aysén, but no further details were provided, and none of the works he cited list any other records beyond those mentioned above.

Here we focus on morphological characters to confirm the validity *Hatcheria macraei* samples collected in Chile. We verify *H. macraei* records from various basins in southern Chile where this species has been reported, and provide new records from as far north as to the Río Imperial, an area well beyond the previous recorded distribution for this species.

MATERIALS AND METHODS

Fishes were sampled using electrofishing as part of two broader projects examining the phylogeography of another trichomycterid catfish, *Trichomycterus areolatus* (Unmack *et al*. in press) and *H. macraei* as well as another project on the ecology of the San Pedro River. We sampled range wide for both species in all major drainages, and many smaller coastal systems, from the Río Baker in the south to the Río Limarí in the north (Unmack *et al*. in press). This included sampling >50 localities, with up to 30 fish collected from each locality. All individuals captured were preserved in 95% ethanol. Fishes were examined under a dissecting microscope. Only principal fin rays were counted, with the last two rays being counted as one since they usually are joined at the base of that ray. Specimens are deposited in the Monte L. Bean Life Science Museum, Brigham Young University (BYU), USA, and in the laboratories of EMH (the second author) and JBJ (the third author). We also included all of the samples in JBJ's collections from Argentina to provide at least some comparison to specimens from Chile.

Arratia & Menu-Marque (1981) revised the genus *Hatcheria* based on a large collection of fish taken from throughout the Río Colorado basin in Argentina. They listed a suite of traits for distinguishing the genus *Hatcheria*, with the following traits being useful for separating *H. macraei* from *T. areolatus* (L. Fernandez pers. comm.): narrow and strongly compressed caudal peduncle; slightly concave dorsal fin, anus placed between the distal end of the pelvic fins, slightly emarginated caudal fin, and a long dorsal fin with more than 17 rays (based on procurrent and principal rays, counted from cleared and stained specimens, G. Arratia pers. comm.). Arratia & Menu-Marque (1981) does note that there is some variation in the position of the anus relative to the pelvic fins, and some fish have slightly lower dorsal ray counts (as low as 15 principal rays). We examined principal dorsal ray counts, position of anus relative to pelvic fins, dorsal and caudal fin shape and caudal peduncle depth.

RESULTS

While examining specimens of *T. areolatus* as part of our phylogenetic work, we noticed the presence of a second species in our collections from Chile. We subsequently examined the morphology of all of our trichomycterid collections in the southern portion of the range of *T. areolatus* to determine if other individuals of *H. macraei* were present. We confirmed the presence of *H. macraei* in Río Imperial, Río Valdivia and Río Bueno, where *H. macraei* occur in small numbers sympatrically with *T. areolatus* (Figure 1, Table I). Only one external morphological character—the shape of the dorsal fin—provided complete discrimination between *H. macraei* and *T. areolatus*. A second character—fin ray count—was nearly diagnostic. We elaborate on these two traits below. All other characters that we examined showed considerable variation between species.

The best diagnostic character we observed to distinguish *H. macraei* from *T. areolatus* was the difference in the overall shape of the dorsal fin between the two species. The dorsal fin of *T. areolatus* is shaped like an isosceles triangle (two sides of the same length), with the fin base being longer, with the leading edge of the fin, and margin of the fin being approximately the same length (Figure 2). In contrast, the dorsal fin in *H. macraei* is shaped like a scalene triangle (where all sides are different lengths), with the base being longest, the fin margin is a little bit shorter, and the front edge of the fin is quite short (Figure 2). In other words, the dorsal fin of *H. macraei* is not very tall, but it is quite long (relative to its height); whereas in *T. areolatus* the fin is higher and shorter.

The second best character to quantify for identification was dorsal fin ray number. Almost

all *H. macraei* had dorsal ray counts of 13 or higher, while almost all *T. areolatus* from the region of sympatry with *H. macraei* have counts of 10 or lower (Table II). However a few fish from both species have counts of 11 or 12, while the Río Manso sample contained three individual *H. macraei* with 10 rays (Table II). These counts are lower than reported by Arratia & Menu-Marque (1981) for *H. macraei*; however, the specimens they examined were all from one river system, the Río Colorado in the northern portion of the range of *H. macraei*, and no information exists on how dorsal ray counts vary across the range of *H. macraei*. Arratia & Chang (1975) reported that counts for *T. areolatus* from a broader geographic sample varied from 9 to 13 (based on principal counts on cleared and stained specimens). Four out of the five populations they examined are from north of our study area; this may partly explain why counts we obtained were typically lower than reported by Arratia & Chang (1975).

TABLE I. Locality data for specimens examined: TA = *Trichomycterus areolatus*, HM = *Hatcheria macraei*. The number in parentheses after the term TA or HM represents the total number of individuals of each species found at that site. Note that not all specimens were counted for all traits.

TABLA I. Localidades de los individuos examinados: TA = *Trichomycterus areolatus*, HM = *Hatcheria macraei*. El número entre paréntesis después del término TA o HM representa el número total de individuos de cada especie encontrados en cada sitio. No todos los individuos fueron incluidos en el conteo de caracteres.

Species (# of individuals)	Locality	River Basin	Latitude			Longitude		
TA (3)	Rio Traiguén	Imperial	-38	14	56.7	-72	39	40.9
TA (7)	Río Imperial	Imperial	-38	15	32.4	-72	9	41.4
TA(30)/HM(3)	Río Imperial	Imperial	-38	43	34.3	-73	5	6.9
TA (30)	Río Cautín	Imperial	-38	46	40.5	-72	47	51.4
TA (29)	Río Toltén	Toltén	-38	59	8.5	-72	37	9.9
TA (15)	Río Allipén	Toltén	-39	0	49.2	-72	30	33.0
HM (30)	Río Cruces	Valdivia	-39	27	14.5	-72	46	52.4
HM (1)	Río Mañio	Valdivia	-39	44	55.8	-72	31	40.8
TA (30)	Río San Pedro	Valdivia	-39	48	8.4	-72	43	27.0
HM (1)	Río Quinchilca	Valdivia	-39	51	0.7	-72	45	19.6
TA(30)/HM(6)	Río San Pedro	Valdivia	-39	51	12.2	-72	45	27.0
TA (19)	Río Pilmaiquén	Bueno	-40	26	21.8	-72	54	47.1
TA(30)/HM(1)	Río Rahue	Bueno	-40	45	45.7	-72	58	14.9
TA (17)	Río La Plata	Llico	-41	0	10.9	-73	36	7.9
TA (22)	Río Blanco	Llico	-41	12	30.6	-73	37	6.7
TA (12)	Lago Llanquihue	Maullín	-41	15	17.0	-73	0	5.8
TA (30)	Río Alerce	Maullín	-41	23	8.0	-72	55	22.8
TA (29)	Río Negro	Maullín	-41	23	48.2	-72	54	28.4
TA (23)	Rio Cudil	I. Chiloé	-42	22	28.6	-73	48	22.1
HM (9)	Río Manso	Puelo	-41	43	35.0	-72	01	07.3
HM (30)	Río Huemules	Aysén	-45	54	22.8	-71	42	42.2
HM (30)	Lago General Carrera at Bahía Murta	Baker	-46	28	5.1	-72	41	36.8
HM (1)	Río Baker	Baker	-47	29	54.3	-72	58	29.1
HM (6)	Lago Largo	Baker	-47	28	6.6	-72	48	11.6
HM (9)	Río Cullin, Argentina	Negro	-38	30	35	-70	27	11
HM (7)	Río Picun Leufu, Argentina	Negro	-39	13	28	-70	3	29
HM (12)	Río Negro, Argentina	Negro	-39	53	43.0	-65	2	51.0
HM (4)	Río Chubut, Argentina	Chubut	-43	20	50.0	-65	40	43.0
HM (5)	Río Deseado trib., Argentina	Deseado	-46	52	53	-70	43	57
HM (7)	Río Pinturas, Argentina	Deseado	-47	4	14	-70	47	46

TABLE II. Dorsal fin ray counts in *Trichomycterus areolatus* and *Hatcheria macraei*. Note that not all *H. macraei* specimens could be counted. Under basin, AR = Argentina.

TABLA II. Conteo de rayos de la aleta dorsal en *Trichomycterus areolatus* y *Hatcheria macraei*. No todos los individuos de *H. macraei* pudieron ser contados. En la columna de cuenca, AR indica Argentina.

Basin	Locality	*T. areolatus*	*H. macraei*	7	8	9	10	11	12	13	14	15	16	17	18
Imperial	Río Traiguén	1					1								
Imperial	Río Imperial	7			1	3	3								
Imperial	Río Imperial	29			4	7	18								
Imperial	Río Cautín	17			6	9	2								
Toltén	Río Toltén	4				3	1								
Toltén	Río Allipén	3			1	1	1								
Valdivia	Río Cruces		3										2	1	
Valdivia	Río Mañio		1						1						
Valdivia	Río Quinchilca		1							1					
Valdivia	Río San Pedro	26	5		6	18	2			2	1	1	1		
Bueno	Río Rahue	12	1		6	6					1				
Maullín	Lago Llanquihue	4			1	3									
Maullín	Río Alerce	30		1	4	7	15		3						
Maullín	Río Negro	29			2	12	13	2							
Chiloé	Rio Cudil	8			1	3	4								
Puelo	Río Manso		9				3	1	2		2	1			
Aysén	Rio Huemules		15						3	5	5	2			
Baker	Lago Largo		5					1	2	2					
Baker	Lago Gral.Carrera		10				3	3	4						
Negro, AR	Río Cullin		9							2	1	3	3		
Negro, AR	Río Picun Leufu		7									2	3	1	1
Negro, AR	Río Negro		6										4	2	
Chubut, AR	Río Chubut		3						1				2		
Deseado, AR	Río Deseado trib.		5						1	4					
Deseado, AR	Río Pinturas		7					2	1	3	1				

All other characters examined had considerable variation and were not diagnostic. Generally, most *H. macraei* had a slightly emarginated caudal fin, but the margin varied such that some caudal fins were clearly truncate. The opposite was true in *T. areolatus* where most caudal fins were truncate, although some were emarginated with variation between, making clear characterizations difficult. The same characteristics were observed in the shape of the dorsal fin margin, with variation in both species from essentially a straight margin to slightly concave. This shape variation was often quite difficult to observe in many individuals due to the fin not being outstretched during preservation. The position of the anus relative to the tips of the pelvic fin also varied considerably, with essentially complete overlap in variation, although in many *T. areolatus* the anus tended to be anterior to the tips of the pelvic fins; in *H. macraei* the anus in many fish was near the pelvic fin tips (Table III). We did not formally measure caudal peduncle depth because differences in preservation techniques among our samples could lead to differences in body shape (ethanol causes considerable shrinkage relative to formalin). However, cursory examination of this trait in *H. macraei* suggests that it shows considerable variation, ranging from quite narrow to a width similar to that found in *T. areolatus*. We did not observe a narrow caudal peduncle in any *T. areolatus*. Lastly, there appears to be a diagnostic difference in the maximum size that each species attains. From the Río Imperial south, *T. areolatus* rarely grow larger than 130 mm TL (BYU 113992), with most specimens being considerably less, whereas one of our specimens of *H. macraei* is 193 mm TL (BYU 113993), and they are reported to reach up to 208 mm TL (Arratia & Menu-Marque 1981).

TABLE III. Anus position relative to pelvic fin tips in *Trichomycterus areolatus* and *Hatcheria macraei* in the first and second half of the table, respectively. The bottom two rows provide frequency data, one for the total count of individuals, the second for the percentage of each category. Note that anus position cold not be determined for all *H. macraei* specimens. Under basin, AR = Argentina.

Tabla III. Posición relativa del ano respecto al ápice de las aletas pélvicas en *Trichomycterus areolatus* y *Hatcheria macraei* en la primera y segunda mitad de la tab la, respectivamente. Al fondo dos filas proveen la frecuencia de datos : la primera por la cuenta total de individuos y la segunda por el porcentaje de cada categoría. Note que la posición del ano no está determinada para todos los especímenes de *H macraei*. Sub Cuenca, AR= Argentina.

Basin	Locality	*T. areolatus*	well short	almost-barely touches	to middle	beyond anus	*H.* macraei	well short	almost-barely touches	to middle	beyond anus
Imperial	Río Traiguén	1		1							
Imperial	Río Imperial	29		18	11						
Imperial	Río Imperial	7	3	4			1		1		
Imperial	Río Cautín	17	7	10							
Toltén	Río Toltén	4	1	3							
Toltén	Río Allipén	2		1		1					
Valdivia	Río Cruces						3		3		
Valdivia	Río Mañio						1	1			
Valdivia	Río Quinchilca						1	1			
Valdivia	Río San Pedro	27	16	10	1		5	1	3	1	
Bueno	Río Rahue	11	4	5	2		1		1		
Maullín	Lago Llanquihue	4		4							
Maullín	Rio Alerce	30	9	21							
Maullín	Río Negro	29	5	24							
Chiloé	Río Cudil	8		7	1						
Puelo	Río Manso						9	1	3	2	3
Aysén	Rio Huemules						15	11	1	3	
Baker	Lago Largo						5	1		4	
Baker	Lago Gral.Carrera						10			4	6
Negro, AR	Río Cullin						9		3	1	5
Negro, AR	Río Picun Leufu						7		1	2	4
Negro, AR	Río Negro						6		2	4	
Chubut, AR	Río Chubut						2			2	
Deseado, AR	Río Deseado trib.						5		1	3	1
Deseado, AR	Río Pinturas						7	2		4	1
Count		169	45	108	16	1	87	18	19	30	20
Percentage			26.6	63.9	8.9	0.6		20.7	21.8	34.5	23.0

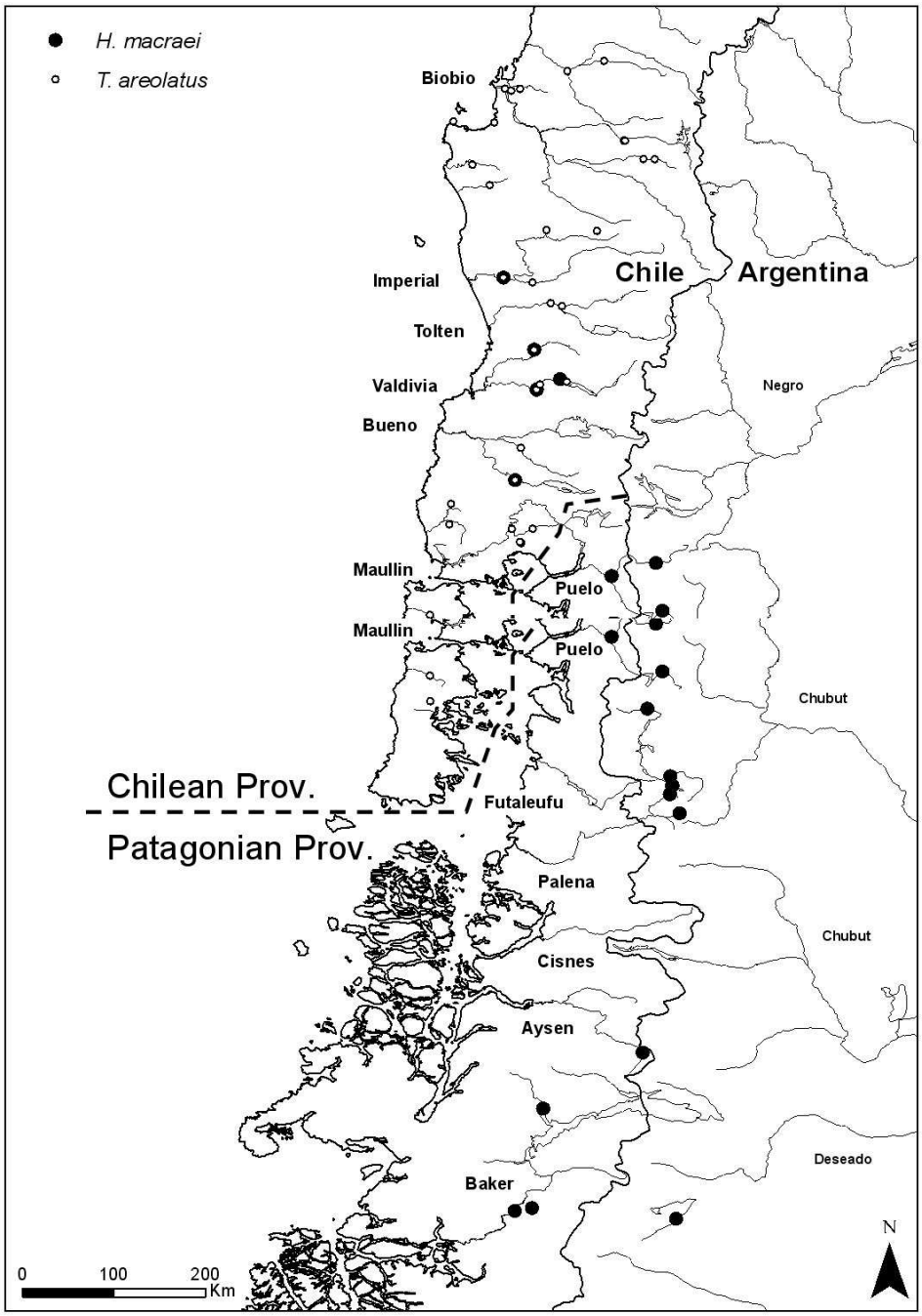

FIGURE 1. Collection records for *Trichomycterus areolatus* (small hollow circles) and *Hatcheria macraei* (solid dots) based on our collections. Overlapping records have both the small hollow circle with a thick black rim. We also included our Argentinean records of *H. macraei* from Pacific draining rivers. The dashed line represents the approximate boundary between the Chilean and Patagonia provinces.

FIGURA 1. Registros de colectas de *Trichomycterus areolatus* (cículos pequeños vacíos) y *Hatcheria macraei* (círculos negros sólidos) basados en nuestras colectas. Con un pequeño círculo vacío de borde negro grueso se indican los registros sobrepuestos para ambas especies. También incluimos registros de *H. macraei* provenientes de cuencas Argentinas que drenan al Pacífico. La línea punteada indica el límite aproximado entre las Provincias Chilena y Patagónica.

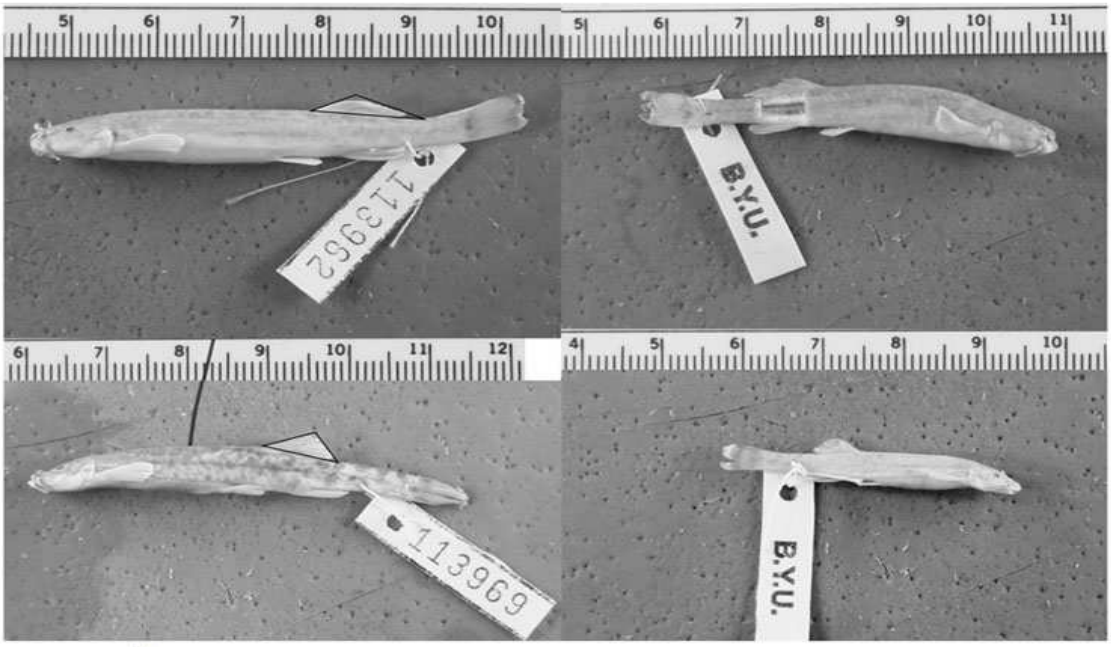

FIGURE 2. Examples of *Hatcheria macraei* (top row) and *Trichomycterus areolatus* (bottom row) from Río San Pedro (top left, BYU 113962 and bottom left, BYU 113969) Río Rahue (top right BYU 67221) and Río San Pedro (bottom right BYU 113981). The triangles drawn on left hand fish highlight the difference in dorsal fin shape between the two species. The scale bar is in centimeters.

FIGURA 2. Ejemplos de *Hatcheria macraei* (fila superior) y *Trichomycterus areolatus* (fila inferior) del Río San Pedro (izquierda arriba, BYU 113962, izquierda abajo BYU 113969) Río Rahue (derecha arriba BYU 67221) y Río San Pedro (derecha abajo BYU 113981). Los triángulos dibujados en las fotos de la izquierda indican la diferencia en la forma de la aleta dorsal de ambas especies. La escala está en centímetros.

DISCUSSION

LACK OF PREVIOUS RECORDS

Why have *H. macraei* not been recorded earlier from these "southern" Chilean rivers? Three factors may have resulted in the lack of detection. The first factor is that *H. macraei* appears to be quite rare relative to *T. areolatus*, with most populations being represented by three or fewer individuals (Table I). This is not simply due to differences in the habitats sampled. Both species are typically abundant in similar habitats when they occur allopatrically, and at most sites all available habitats were sampled. *Hatcheria macraei* may simply be rare due to competition with *T. areolatus*, as typically, *H. macraei* are more common where they occur in allopatry. The second reason these populations may have escaped detection is that one of the key characters used previously for field identification is lacking in these new Chilean populations. Most references to identification of *Hatcheria* highlight the narrow caudal peduncle (e.g., Arratia *et al* 1981; Ruiz & Marchant 2004). However, none of the fish from this area of Chile have a thin caudal peduncle. Moreover peduncle depth appears to vary considerably, both within populations and among populations across the range of *H. macraei* (Arratia & Menu-Marque 1981). Thus, without closer inspection of the dorsal fin it would be easy to overlook the presence of *H. macraei*. Quantification of variation in the caudal peduncle depth across the range of *H. macraei* will be helpful in determining its value in identification relative to *T. areolatus*. We suspect that some fish identified as *T. areolatus*

from Argentina (Arratia & Menu-Marque 1981; Baigún & Ferriz 2003) may be based on *H. macraei* that have low dorsal ray counts and thicker caudal peduncles which making them quite similar in appearance to *T. areolatus*. The third factor hindering earlier detection of *H. macraei* is that most of these rivers that expand the range of this species are poorly sampled, with little published information on specific collections (Campos *et al.* 1987; Dyer 2000; Habit *et al.* 2006). *Hatcheria macraei* appear to be absent from smaller coastal drainages in this area and from the Río Maullín; our collections from these areas only contain *T. areolatus*. Given the small populations sizes of *H. macraei*, it is possible that this species could not persist in smaller rivers. It is possible that *H. macraei* are present in Río Toltén, although additional sampling is required to demonstrate this.

BIOGEOGRAPHIC IMPLICATIONS

These new records extend the range of *H. macraei* across the boundary between the Patagonian and Chilean biogeographic provinces of southern Chile (Dyer 2000; Figure 1). Interestingly, this new northern limit identically matches another predominately Patagonian species, *Galaxias platei* (Campos 1985; Cussac *et al.* 2004). Of the eight or nine species known from Patagonian Province in Chile (Dyer 2000; Cussac *et al.* 2004), only the silverside fish *Odontesthes hatcheri* does not extend into Chilean Province. This boundary represents a strong barrier to the southern movement of many species due to recent glaciation, but apparently most Patagonian species have managed to cross this boundary at some stage of their biogeographic history. For some species this pattern might be explained by a diadromous life cycle that allows individuals to move easily between river mouths via the ocean. For strictly freshwater species, such as *H. macraei* and *Percichthys trucha*, explanations may be more complicated as populations could have reinvaded glaciated areas from either non-glaciated regions of Argentina and Chile, or from refugia within the glaciated area. Ongoing phylogeographic work on both species will likely provide information on the origins and relationships of these populations as well as a time frame for their biogeographic history.

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